**Model Development Phase**

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| **Date** | 17 June 2025 |
| **Team ID** | SWTID1749876754 |
| **Project Title** | SynapseScan: AI Driven Classification of Ovarian Cancer Variants |
| **Maximum Marks** | 5 Marks |

**Feature Selection Report**

In the forthcoming update, each feature will be accompanied by a brief description. Users will indicate whether it's selected or not, providing reasoning for their decision. This process will streamline decision-making and enhance transparency in feature selection for CNN-based image classification models.

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| **Feature** | **Description** | **Selected (Yes/No)** | **Reasoning** |
| InceptionV3 Base Model | Pre-trained InceptionV3 model from ImageNet for transfer learning | **Yes** | Provides robust feature extraction capabilities with proven performance on medical imaging tasks. Pre-trained weights capture low-level features essential for image classification. |
| Image Rescaling (1./255) | Pixel normalization to scale image values between 0-1 | **Yes** | Essential preprocessing step for neural networks to ensure stable training and faster convergence by normalizing input pixel values. |
| Image Resizing (224x224) | Standardizing input image dimensions to 224x224 pixels | **Yes** | Required for InceptionV3 architecture compatibility and ensures consistent input dimensions across all medical images for optimal processing. |
| Differential Attention Layer | Custom attention mechanism with query, key, value transformations | **Yes** | Enhances the model's ability to focus on critical regions in histopathological images, improving classification accuracy for subtle cancer variant differences. |
| Global Average Pooling | Reduces spatial dimensions while preserving important features | **Yes** | Prevents overfitting compared to fully connected layers and maintains spatial information while reducing computational complexity. |
| Gaussian Noise Layers | Regularization technique adding random noise during training | **Yes** | Acts as regularization to improve model generalization and robustness, particularly important for medical imaging where data variations are common. |
| Batch Normalization | Normalizes layer inputs to stabilize training | **Yes** | Accelerates training convergence and provides regularization effect, crucial for deep CNN architectures in medical image analysis. |
| Dropout Layer (0.25) | Randomly sets 25% of input units to 0 during training | **Yes** | Prevents overfitting by reducing co-adaptation of neurons, essential for small medical datasets to improve generalization. |
| Dense Layer (512 units) | Fully connected layer with 512 neurons and ReLU activation | **Yes** | Provides sufficient capacity for learning complex patterns in cancer variant classification while maintaining computational efficiency. |
| RandomOverSampler | Balances class distribution by oversampling minority classes | **Yes** | Addresses class imbalance in medical datasets, ensuring fair representation of all ovarian cancer variants during training. |
| Early Stopping | Stops training when validation loss stops improving | **Yes** | Prevents overfitting and saves computational resources by automatically stopping training at optimal performance point. |
| Adam Optimizer (lr=0.0001) | Adaptive learning rate optimization algorithm | **Yes** | Provides efficient and stable convergence for medical image classification tasks with appropriate learning rate for transfer learning. |
| Data Augmentation | Techniques like rotation, flipping to increase dataset diversity | **No** | Not implemented in current model. Could be beneficial for increasing dataset size and improving generalization, but may alter critical medical features. |
| Multiple Frozen Layers | Freezing all InceptionV3 base model layers | **Yes** | Preserves pre-trained ImageNet features while allowing custom layers to learn domain-specific medical imaging patterns. Reduces training time and prevents overfitting. |